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Clean Hydrogen Partnership

AndreaH

HYCELTEC 2024
Milazzo (Italy), June 30-July 03, 2024

IX Symposium on Hydrogen, Fuel Cells and Advanced Batteries

AmmoNia baseD membRane rEActor for green Hydrogen production

June 2023 - May 2027

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"The project is supported by ***the Clean Hydrogen Partnership*** *and its members* ***Hydrogen Europe and Hydrogen Europe Research****."*

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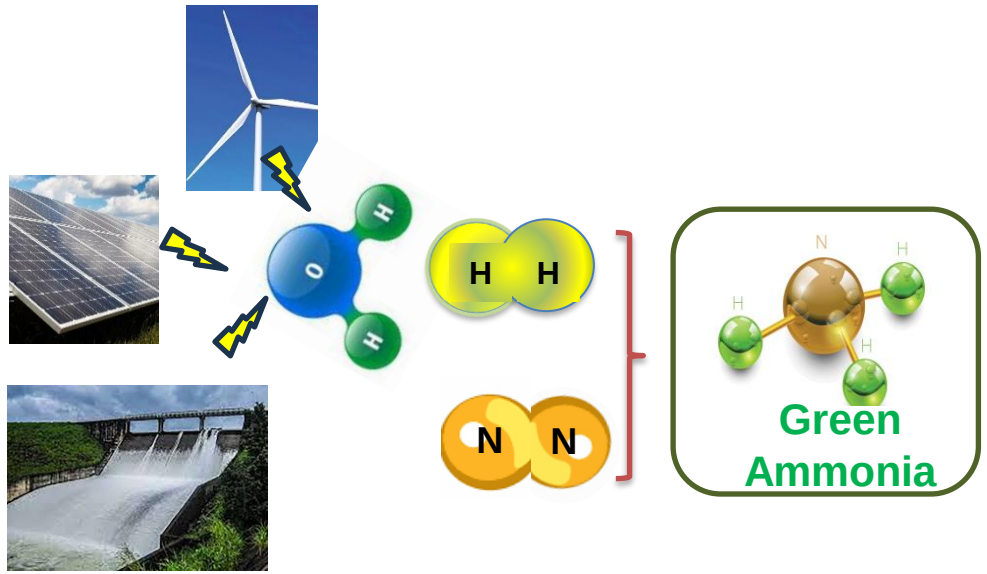
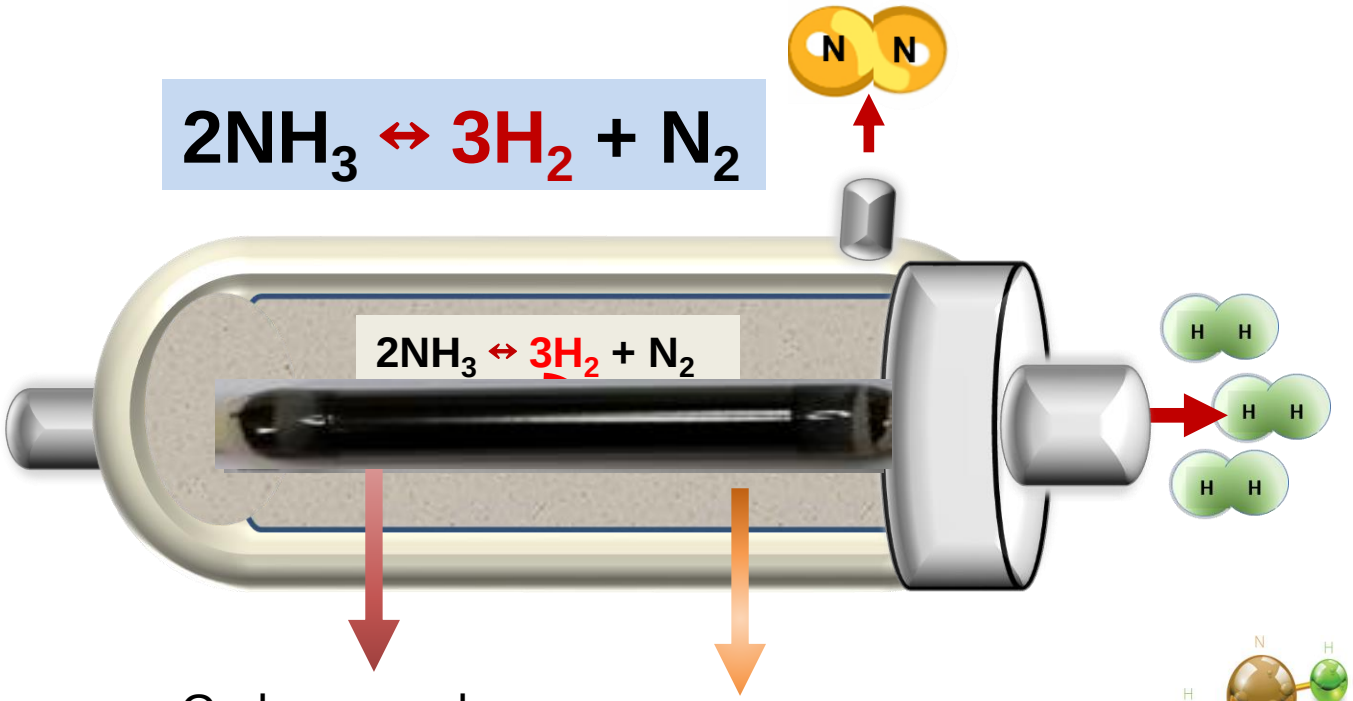
Andreah concept

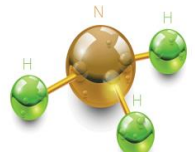


$2NH_3 \leftrightarrow 3H_2 + N_2$



Carbon membrane
H_2 selective

Catalyst



Adsorbent

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Aims

- Development advanced ammonia decomposition technologies to produce ultra-pure hydrogen (>99.998%) by developing an innovative system based on a Catalytic Membrane Reactor (CMR) for the cracking of Ammonia.
- Designing and setting up a broad and complete network of value chains.
- Developing a set of flexible cost-effective and environmentally friendly technologies
- Laying the foundations for new business opportunities related to new catalysts and membranes integrated into membrane reactors to provide huge process intensification

ANDREAH will work through a holistic approach to tackle both the centralized and decentralized hydrogen generation from ammonia and develop a flexible and efficient ammonia cracking technology able to satisfy the decarbonization of hard to abate sectors.

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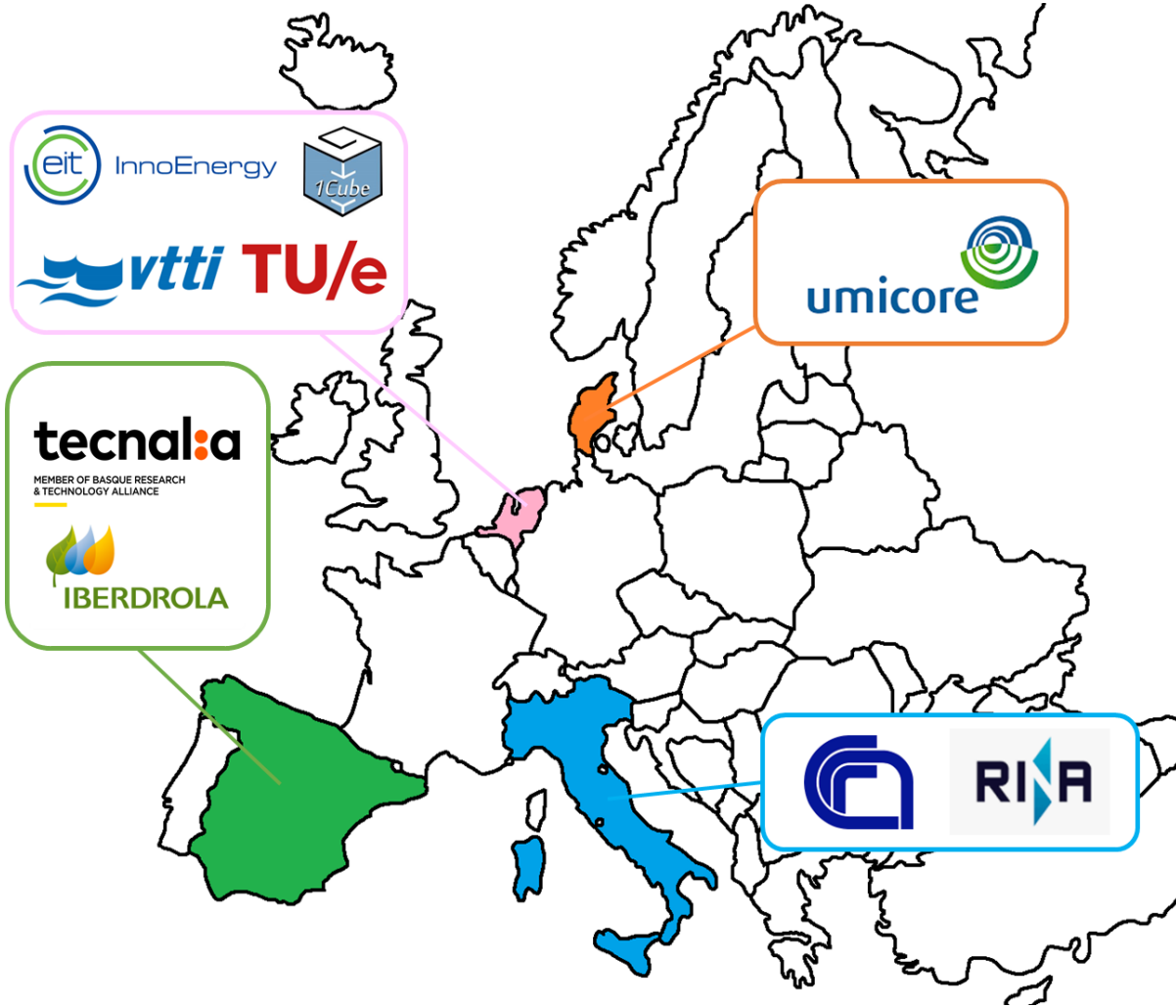
- **9** partners from 4 countries .
- **6** SME/IND + **3** RTD partners (44% SME/IND; 28% SME)
  - **Companies** specialised in materials development (UMICORE), energy multinational companies (IBERDROLA) and energy storage provider structure developer (VTTI).
  - European Research Institutes and Universities will collaborate (TUE, CNR and TEC) to turn AMBHER objectives into results that can later be scaled-up and exploited
  - LCA, LCC and HSA will be performed by **RINA-C** and tailored dissemination and communication strategies led by **1CUBE**



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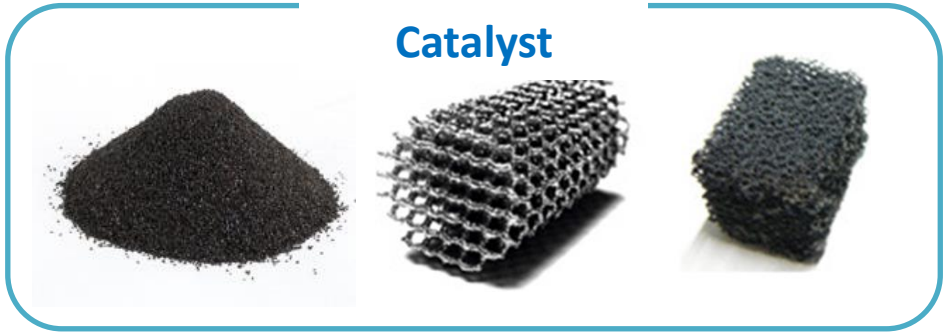
1. Main goal and S&T targets

- To develop and demonstrate at 10 kgH_2/day scale, NH_3 cracking system based on Catalytic membrane Reactor Technology using Carbon Molecular Sieve Membranes integrated with Novel Catalyst .

  - Structured catalyst that can be used at low temperatures 400-450 C with low (<1wt%) Ru content (using not critical Ni) supported on heat conductive 3D printed Periodic Open Cellular Structures (POCS)



  - H_2 selective Carbon Membranes.

  - NH_3 sorbents to improve the H_2 purity

- To develop a full Life Cycle Analysis (LCA,) Life Cycle costing (LCC) and Health and Safety Analysis (HSE) of ANDREAH

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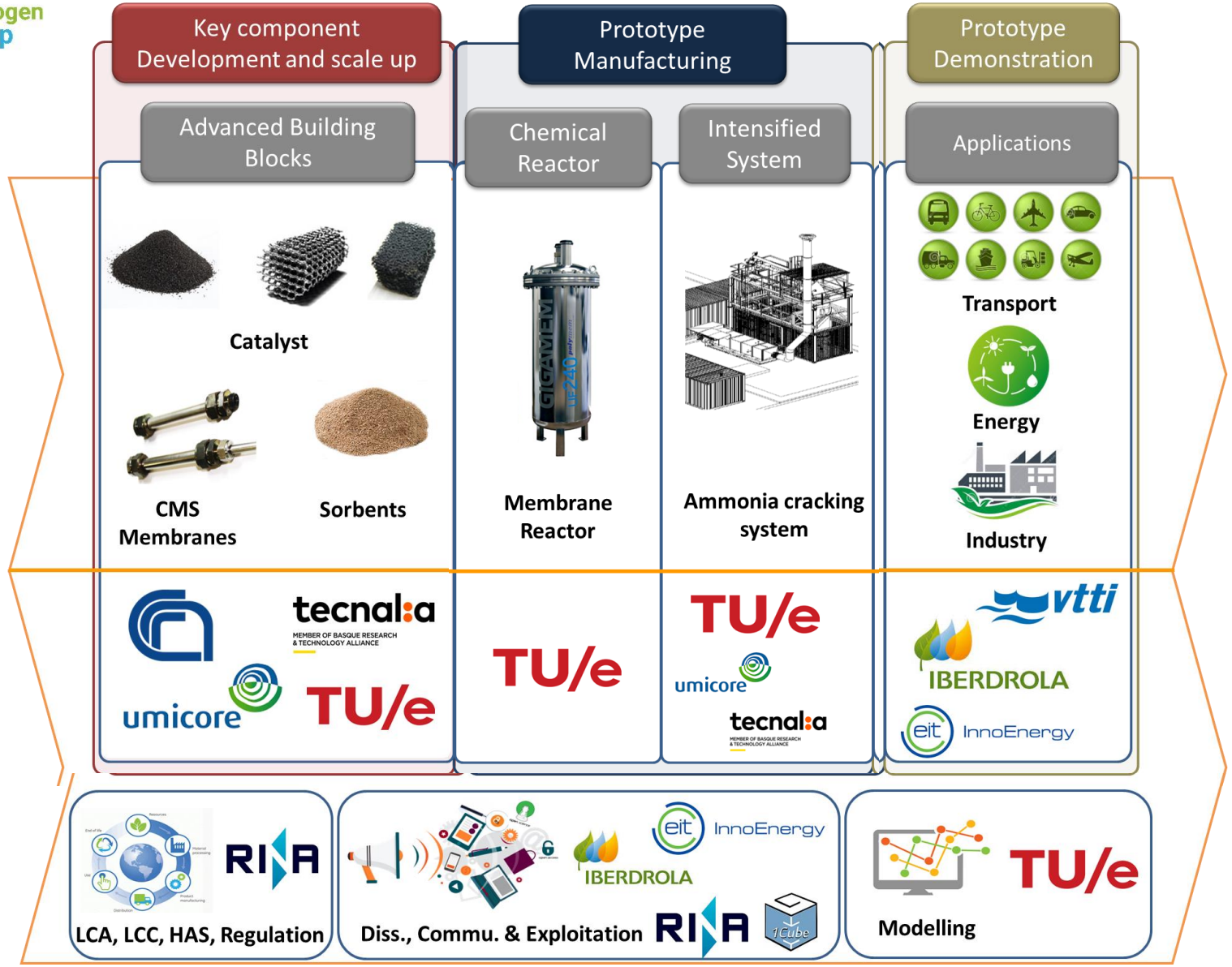

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Overall approach and methodology

Phase 1 (M1-M24). R&D-Key component optimization and selection

Phase 2 (M24-M42). Scale up and Prototypes construction

Phase 3 (M42-M48). Demonstration at TRL5

WP1. Business case definition & Exploitation — IBERDROLA

WP2. System requirements, design and modelling
Of key components: Catalyst, membranes, sorbents, reactors and overall system — TU/e

WP3. Key component development and scale up
Development and scale-up of catalysts, sorbents and membranes that will be integrated in the prototype. By M24, the key components will be selected and afterwards scaled-up. In parallel further studies and optimization will be performed until the end of the project To TRL5

To TRL4

WP4. System integration and validation
- Development of the Ammonia Cracking system.
- Validation of the prototype at VTTi at TRL5

vtti

WP5. Environmental and Social LCA and economic assessment
LCA, LCC, Health and Safety of the prototype systems — RINA

WP6. Dissemination and communication — 1Cube

WP7. Project Management — tecnalia

Selection of most promising Key components & System design

Prototypes ready for delivery

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Expected results

- **ER1: Advanced Ammonia decomposition system** based on Membrane Reactor technology for hydrogen production
- **ER2: Innovative environmentally friendly catalyst materials** that can be used at much lower temperatures compared to conventional ammonia decomposition.
- **ER4: Innovative carbon membranes** for selective separation of hydrogen during the gas phase production process.
- **ER4: Recipes for the activation of OCFs and 3D-printed POCSs** with the catalyst.
- **ER5: Novel sorbents for polishing** the H_2 recovered by the membranes

KER (key exploitable results)

KER2: Advanced NH_3 cracking system based on Membrane Reactor technology for H_2 production.

Main partner: TUE/TEC/CNR (Participates: IBER, UMI,VTTI, KIC)

Value proposition: Ammonia decomposition system based on advance catalysts and membranes integrated into catalytic membrane reactor coupled with sorbent-based polishing technology.

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Thank you for your attention